FIVE SPECIES OF KLEPTOBIOTIC *ARGYRODES* SIMON (THERIDIIDAE: ARANEAE) FROM EASTERN AUSTRALIA: DESCRIPTIONS AND ECOLOGY WITH SPECIAL REFERENCE TO SOUTHEAST QUEENSLAND

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Many spiders of the genus *Argyrodes* Simon (Theridiidae) live on webs of large spiders and steal food (kleptobiosis). Although more than 45 species of *Argyrodes* may occur in Australia, little is known of their taxonomy and ecology. I provide diagnoses, geographical distributions and notes on ecology of 5 *Argyrodes* species commonly found on webs of orb weavers in southeast Queensland. Of these, previously named species include *A. antipodianus* Pickard-Cambridge, *A. miniaceus* (Doleschall), *A. rainbowi* (Roewer) and *A. fissifrons* Pickard-Cambridge. *A. musgravei* Rainbow is synonymised with *A. miniaceus*. A new species, *A. alannae* is described. ❐ *Argyrodes, kleptoparasite, kleptobiosis, host, Theridiidae, spider, ecology, systematics, Australia.*

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Argyrodes species (Theridiidae) are small spiders, found mostly in the tropics and subtropics throughout the world (Exline & Levi, 1962; Levy 1985). Two genera, *Rhomphaea* L. Koch and *Ariamnes* Thorell, are presently included in *Argyrodes* (Levi & Levi, 1962). The synonymised genera were distinguished by the clypeal modification of male cephalothorax, eye arrangement and relative length of metatarsi (Simon, 1894), but Levi & Levi (1962) noted that these characters did not reliably separate the taxa.

Many species of *Argyrodes* are known to be closely associated with large orb-weavers and other web-building spiders (Exline & Levi, 1962; Vollrath, 1984; Vollrath, 1987; Elgar, 1993). These small web inhabitants rarely catch their own food, but instead specialise in the removal and consumption of prey caught in webs of their hosts. This unusual foraging behaviour has earned them the name of 'kleptobionts' or 'kleptoparasites' (Vollrath, 1984, 1987; Elgar, 1993). However, the ecology of kleptobiotic *Argyrodes* and the nature of their relationship with hosts are little known (Elgar, 1993).

Little information is available on the taxonomy of Australian species of *Argyrodes*. Over 45 species may occur in Australia (Roewer, 1942; Bonnet, 1957; Brignoli, 1983; Platnick, 1987; Platnick, 1991), but only one taxonomic paper that included Australian collections (Gray & Anderson, 1989) has been published since 1916. I diagnose 5 species of *Argyrodes* that are commonly associated with orb-weaving spiders in southeast Queensland, with the distribution of these kleptobionts in eastern Australia and with notes on their ecology, including host-specificity.

METHODS

Terminology. In the female: insemination duct joins gonopores to spermathecae; fertilisation duct joins spermathecae to ovaries. In the male: cephalic projection is the upper frontal cephalothoracic projection, bearing median eyes; clypeal projection is the lower frontal cephalothoracic projection (arising underneath cephalic projection), without eyes.

Names of sclerites of male palpal bulb (Fig. 2F) follow Coddington (1990), who disputed some earlier terminology. For example, he suggested that the sclerite termed 'median apophysis' by Exline & Levi (1962) was an autapomorphic outgrowth of the tegular wall, and renamed it 'tegular apophysis'. The sclerite contains a loop of the seminal duct (Fig. 2F). Further, Coddington proposed that Exline & Levi's 'radix' might be '... the median apophysis (in a developmental sense).' Here, I call it the extension of median apophysis. All specimen measurements are given in mm.

Abbreviations. Institutions: AM, Australian Museum, Sydney; HEC, Hope Entomological Collection, Oxford University Museum, Oxford,

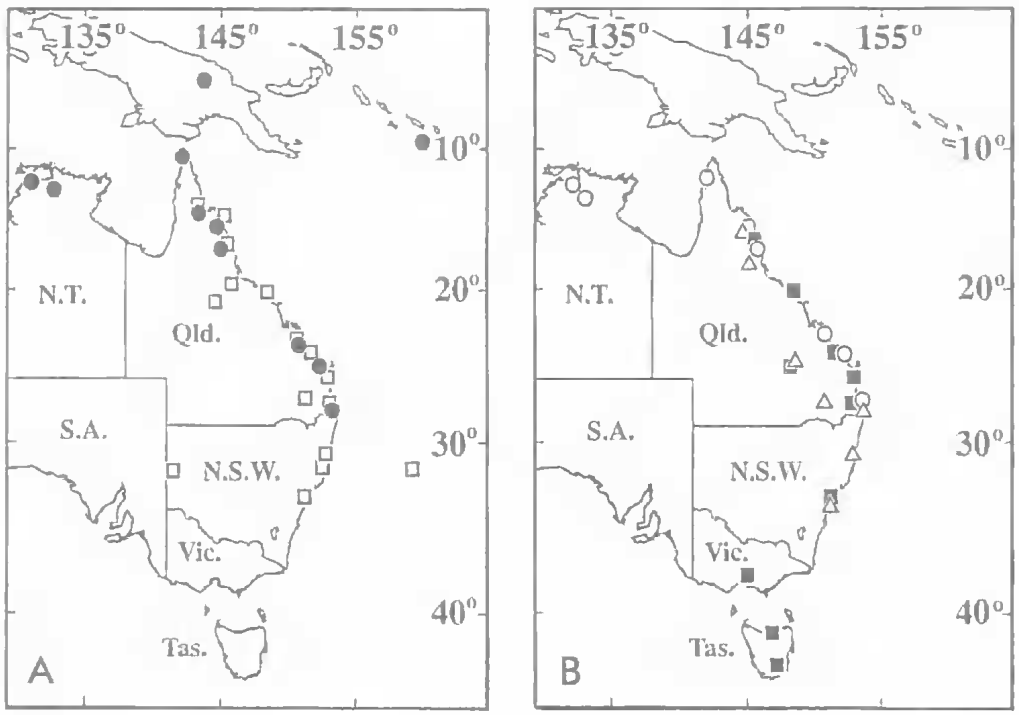

FIG. 1. Collection localities of five species of *Argyrodes* from AM and QM collections. *A. antipodianus*; ● *A. miniaceus*; ▽ *A. rainbowi*; ■ *A. alannae*; ○ *A. fissifrons*.

UK; NHMW, Naturhistorisches Museum, Wien, Austria; QM, Queensland Museum. Morphology: AME, Anterior median eyes; PME, Posterior median eyes; ALE, Anterior lateral eyes; PLE, Posterior lateral eyes; AL, abdomen length; AH, abdomen height; AI, abdomen index; CL, carapace length; CI, carapace index.

SYSTEMATICS

Argyrodes Simon, 1864

Argyrodes Simon, 1864: 253. Type species by tautonymy *Linyphia argyrodes* Walckenaer, 1841 (Levy, 1985). Synonymy follows Levi & Levi (1962).

DESCRIPTION. (from Exline & Levi, 1962; Levy, 1985). Cephalothorax: male carapace with a projecting cephalic and/or clypeal region, otherwise with a deep seam under anterior median eyes. Female carapace relatively flat, without projections or fissures. Chelicerae with several teeth. Legs: 1st pair longest, 2nd and/or 4th second in length, 3rd shortest. Comb setae on 4th tarsus usually absent, but serrated bristles usually present. Third tarsal claw longer than paired. Male palp: cymbium with small hook (paracymbium, Fig. 2F) behind bulb, on edge of alveolus. Abdomen shape variable, but rarely oval; sometimes conical/triangular (higher than long), or vermiform (e.g. *Ariamnes* species group), often extending beyond spinnerets. Fleshy colulus (usually with two short setae) in front of spinnerets. Silver-coloured speckles of varying density on abdomen of many species.

REMARKS. The five species described herein are not the only kleptobiotic species of *Argyrodes* in southeast Queensland. Two other species: *A. kulczynskii* (Roewer, 1942) and an undescribed species (sp. 1) occur on webs of other spiders and were also collected in the area (QM). Consequently, this paper is not a geographic review, but a description of five common species. I distinguish the described species from other sympatric or related species in the Diagnoses. The taxonomy of the remaining two species is currently being studied.

Characters common to the five species. Abdomen never vermiform (e.g. *A. colubrinus* (Keyserling, 1889); see Ecology and Behaviour) and without hooks on apex. For males, extension of median apophysis is denticulate distally. Unlike males of species 1 (undescribed, QM

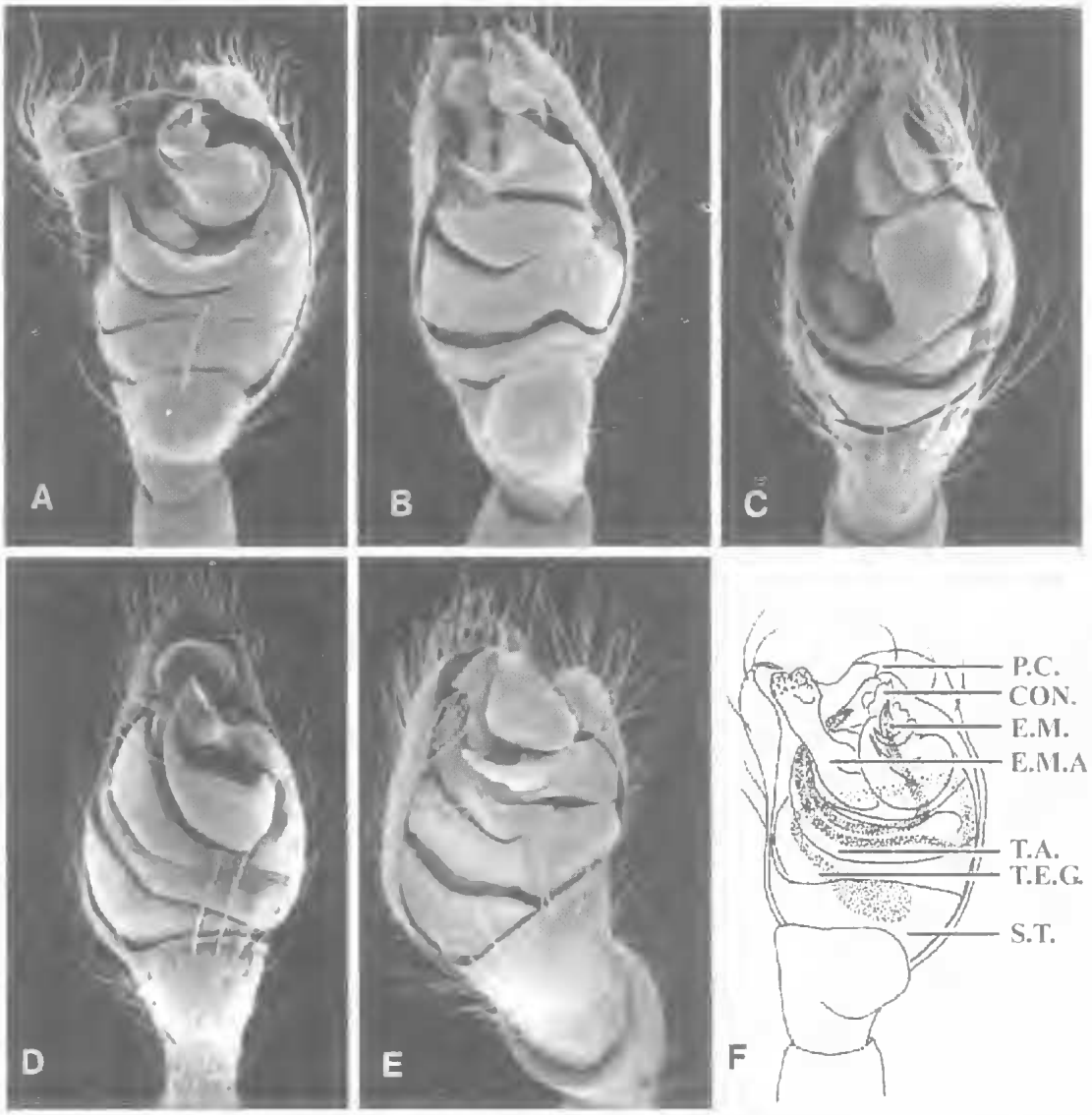

FIG. 2. Scanning electron micrographs of male palps. A, *A. antipodianus*; B, *A. miniaceus*; C, *A. rainbowi*; D, *A. alannae sp. nov.*; E, *A. fissifrons*.F, *A. antipodianus*, P.C. = paracymbium, CON. = conductor, EM. = embolus, E.M.A. = extension of median apophysis, T.A. = tegular apophysis, TEG. = tegulum, S.T. = sub-tegulum, stipled section = seminal duct.

S42030) which lack a clypeal projection, males of all five species described below have both clypeal and cephalic projections (for *A. rainbowi* and *A. kulczynskii* the projections appear fused).

Argyrodes antipodianus
Pickard-Cambridge, 1880
(Figs 2A,F, 3A-K)

† *antipodiana* Pickard-Cambridge, 1880: 327: Bonnet, 1957 (=*A. antipodianus*): 707.

A. conus Urquhart, 1884: 40, pl. 10, fig. 6 (first synonymised by Dalmas, 1917).

Argyrodina antipodiana Roewer, 1942: 434.

MATERIAL. TYPES: *A. antipodianus* (*-na*) Pickard-Cambridge, 1880, (presumed types; see Remarks), F's, juv., New South Wales, Australia (bottle 555, tube 19), New Zealand (bottle 555, tube 13) (HEC). OTHER MATERIAL: New South Wales - AMKS9387, M, Taree, 31°53'S, 152°29'E; AMKS49165, Currawong, Broken Bay, 33°36'S, 151°18'E; AMKS49166, Scone, 32°03'S, 150°52'E; AMKS49167, Petersham, 33°53'S, 151°09'E;

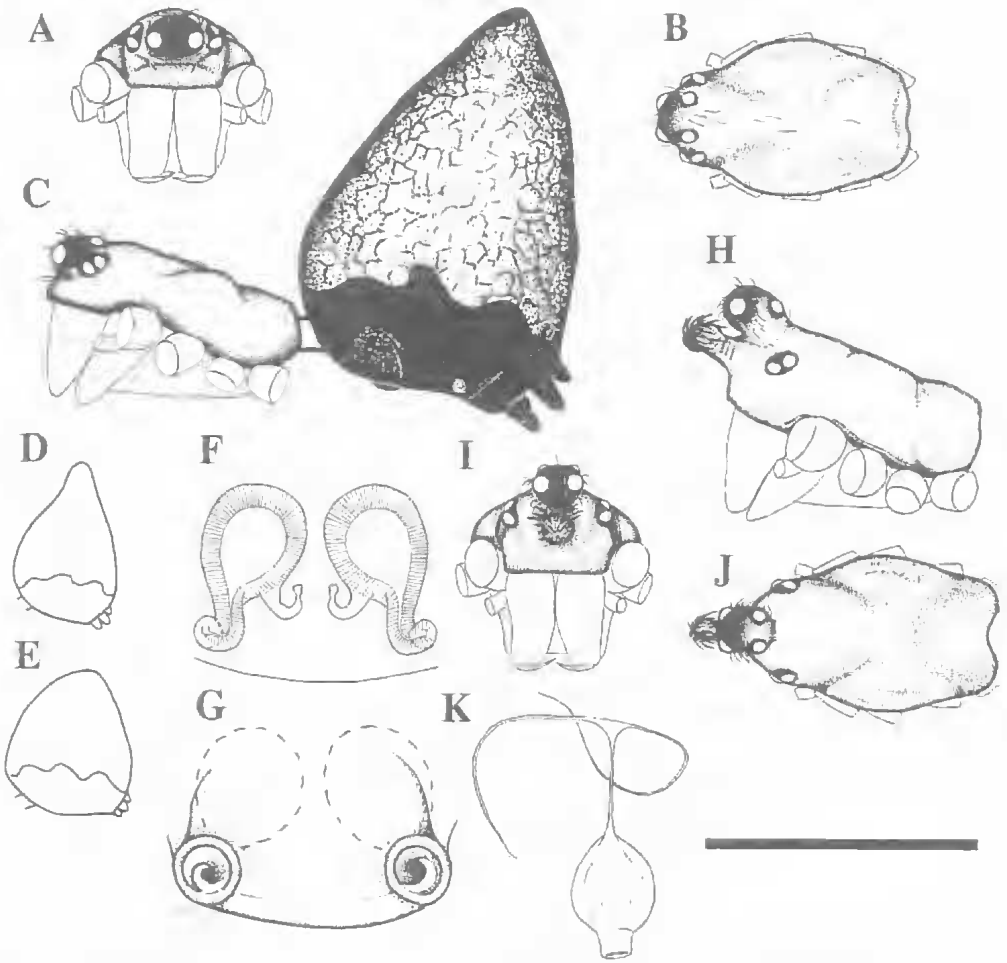

FIG. 3. *A. antipodianus*. A-C, female cephalothorax and abdomen; D, E, variation in shape of female abdomen; F, spermathecae and fertilisation ducts; G, epigyne; H-J, male cephalothorax; K, egg sac. Scale bars: A-D, G, H = 1.2mm; D, E = 4.7mm; F, G = 0.229mm; K = 7.9mm.

AMKS49168, F, Pittwater, 33°38'S, 151°18'E; AMKS49171, F, Wagstaff, 33°32'S, 151°21'E; AMKS49172, M, F, Broken Hill, 31°58'S, 141°27'E; QMS29895, M, Turners Dip, 31°01'S, 152°42'E; QMS46645, M, Sydney, 33°53'S, 151°13'E. Queensland - AMKS12818, M, F, Mt Drylander, via Proserpine, 20°15'S, 148°32'E; AMKS17588, F, Fitzroy I., 16°56'S, 146°00'E; AMKS19744, F, Fletchers Ck, via Charters Towers, 19°49'S, 146°03'E; AMKS49147, F, Lizard Island, Great Barrier Reef , 14°40'S, 145°28'E; AMKS49154, M, F, Mossman, 16°28'S, 145°28'E; AMKS49158, F, Edmonton, 17°01'S, 145°45'E; QMS29823, M, Freshwater Ck, Cairns, 16°55'S, 145°41'E; QMS29839,F, Qld; QMS29840, 2F, Bundaberg Forest, 24°52'S, 152°21'E; QMS29846, 2M, 2F, North Keppel I., 23°04'S, 150°53'E; QMS29848, F, QMS29944, F's, Kroombit Tops, 24°22'S, 151°01'E; QMS29850, M, F, Eureka Ck, 17°09'S, 144°59'E; QMS29855, M, Majors Mt, 17°37'S, 145°32'E; QMS29859, F, Double I., Cairns, 16°44'S, 145°41'E; QMS29861, F, Yungaburra, 17°17'S, 145°35'E; QMS29887, M, Peak Downs, 22°15'S, 148°11'E; QMS29896, 5F, Coen, 13°56'S, 143°12'E; QMS29899, 2M, F, Mt Garnet, 17°41'S, 145°07'E; QMS29939, M, 2F, Chillagoe, 17°09'S, 144°31'E; QMS29940, 2F, Lake Broadwater, via Dalby, 27°20'S, 151°05'E; QMS29941, F, D'Aguilar, 26°59'S, 152°48'E; QMS29942, F, Hughenden, 20°51'S, 144°12'E; QMS46598, M, QMS46599, M, QMS46648, F, Pinkenba, Brisbane, 27°26'S, 153°07'E; QMS46605, M, QMS46606, M, QMS46634, F, QMS46635, F, QMS46642, 2M, 3F, Yeppoon, 23°08'S, 150°45'E; QMS46608, M, QMS46609, M, QMS46630, F, Cairns, 16°55'S, 145°46'E; QMS46611, M, QMS46628, F, QMS46629, F, QMS46652, 17F, Gladstone, 23°51'S, 151°16'E; QMS46617, F, QMS46619, F, QMS46622, F,

QMS46643, 4F, QMS46644, 10F, 1 juv., Nathan, Brisbane, 27°33'S, 153°03'E; QMS46625, F, QMS46641, 2F, QMS46646, M, 2F, North Stradbroke I., 27°35'S, 153°27'E; QMS46626, F, QMS46649, 3M, 9F, Kabra, 23°28'S, 150°24'E; QMS46627, F, Chapel Hill, Brisbane, 27°28'S, 153°03'E; QMS46638, M, 2F, St Lucia, Brisbane, 28°27'S, 153°01'E.

DIAGNOSIS. Abdominal colour (bright silver), combined with morphologies of male palp, male carapace and epigyne separate *A. antipodianus* from other sympatric species. Palpal cymbium conspicuously bi-lobed, base of embolus with two pointed projections, extension of median apophysis narrow and concave distally (Fig. 2A,F). Lateral eyes (ALE and PLE) of males below base of cephalic projection (character shared by *A. miniaceus*), but clypeal projection club-shaped and with pectinate setae (Fig. 3H-J) contrasting with remaining species (including *A. miniaceus*). Epigynal fossae conspicuous, circular and (unlike remaining species) separated by about twice their diameter (Fig. 3G). Unlike for *A. rainbowi*, *A. fissifrons* or *A. kulczynskii*, insemination duct is short and slightly curved (Fig. 3F). *Argyrodes argentatus* Pickard-Cambridge, 1880 (see Remarks) closely resembles *A. antipodianus* in size, shape and colour, but differs in shape of male carapace. Cephalic projection of *A. argentatus* (lectotype, East Indies, HEC) curves downward and touches (or almost touches) clypeal projection distally (this character is not clear in the illustration of *A. argentatus* by Exline & Levi (1962; fig. 148)), but cephalic projection of *A. antipodianus* is approximately straight and conspicuously separated from clypeal projection (Fig. 3H).

DESCRIPTION. *Male*. Total length 2.35-2.97 (n=13). CL 1.23-1.66, CI 1.63-1.87. AL 1.12-1.83, AI 1.05-1.39, AH 1.37-2.00. Palp 1.29-1.74, leg I 5.00-7.98, leg II 3.03-5.03, leg III 1.72-2.49, leg IV 2.46-3.60. Leg formula 1243. Cymbium length ca. 0.6, width ca. 0.4.

Colour of carapace dark brown, darker around AME and ALE; legs yellowish, pale brown near joints; palps yellowish, except for tarsus (dark brown/black); sternum black to brown; abdomen bright silver dorsally; black mid-dorsal band about as thick as tibia IV originating at pedicel and usually reaching tip of abdomen. A dark spot on abdominal tip of most specimens, but sometimes not clearly visible (perhaps faded in preservative). Ventral surface black to about 1/3 of height of abdomen (see female, Fig. 3C). Two lateral, bright silver spots between epigyne and spinnerets on ventral abdomen.

Abdomen conical/triangular, dorsal tip usually not extending posteriorly beyond spinnerets.

Female. Total length 2.57-3.29 (n=13). CL 1.09-1.26, CI 1.24-1.62. AL 1.46-2.83, AI 1.04-1.28, AH 1.77-4.23. Palp 8.30-1.00, leg I 5.32-6.26, leg II 3.55-4.03, leg III 1.77-2.32, leg IV 2.97-3.37. Leg formula 1243. Epigyne width ca. 0.3.

Colour as for male, except both tibia and metatarsus of palp are dark brown. Carapace relatively wide (see CI). Abdomen cone-shaped (Fig. 3C). Epigyne with thickened lateral ridge.

Egg sac chamber urn-shaped, globular, ca. 3.3 long, 2.5 wide; exit hole relatively wide (Fig. 3K).

DISTRIBUTION AND ABUNDANCE. Eastern Australia, Lord Howe I., New Zealand (Pickard-Cambridge, 1880; Urquhart, 1884; pers. obs.).

In Australia, specimens have been collected from warm temperate coastal regions (e.g. Sydney, NSW) to the tropics (e.g. Coen, north Qld). The spider has also been found in relatively dry, inland areas (e.g. Broken Hill, NSW) (Fig. 1A). This is probably the most common species of kleptobiotic *Argyrodes* in southeast Queensland, where adults can be abundant throughout the year.

REMARKS. Bonnet (1957) pointed out that the name *Argyrodes* is masculine, and changed the original name to *A. antipodianus*. A holotype of *A. antipodianus* was not designated by Pickard-Cambridge (1880) (M. Atkinson, pers. comm.), but collector and locality data (H.H.B. Bradley, NSW and F.W. Hutton, New Zealand) of females from HEC match those in the original description. Conspecificity with Pickard-Cambridge's material was established on the basis of female characteristics, as the original collection did not include males.

I did not examine the material collected by Rainbow (1902: 524), Rainbow (1916: 50), Dalmas (1917: 353, fig. 29) and Berland (1924: 197, fig. 65), and the literature did not provide sufficient data to establish conspecificity with the specimens described here. However, the carapace of males from New Caledonia, identified as *A. antipodianus* by Berland (1924), is very similar to that of males from the Australian collections. Specimens of *A. argentatus* were collected from Papua New Guinea (Chrysanthus, 1975) and perhaps are also found in northern Australia. I could find no difference in epigyne

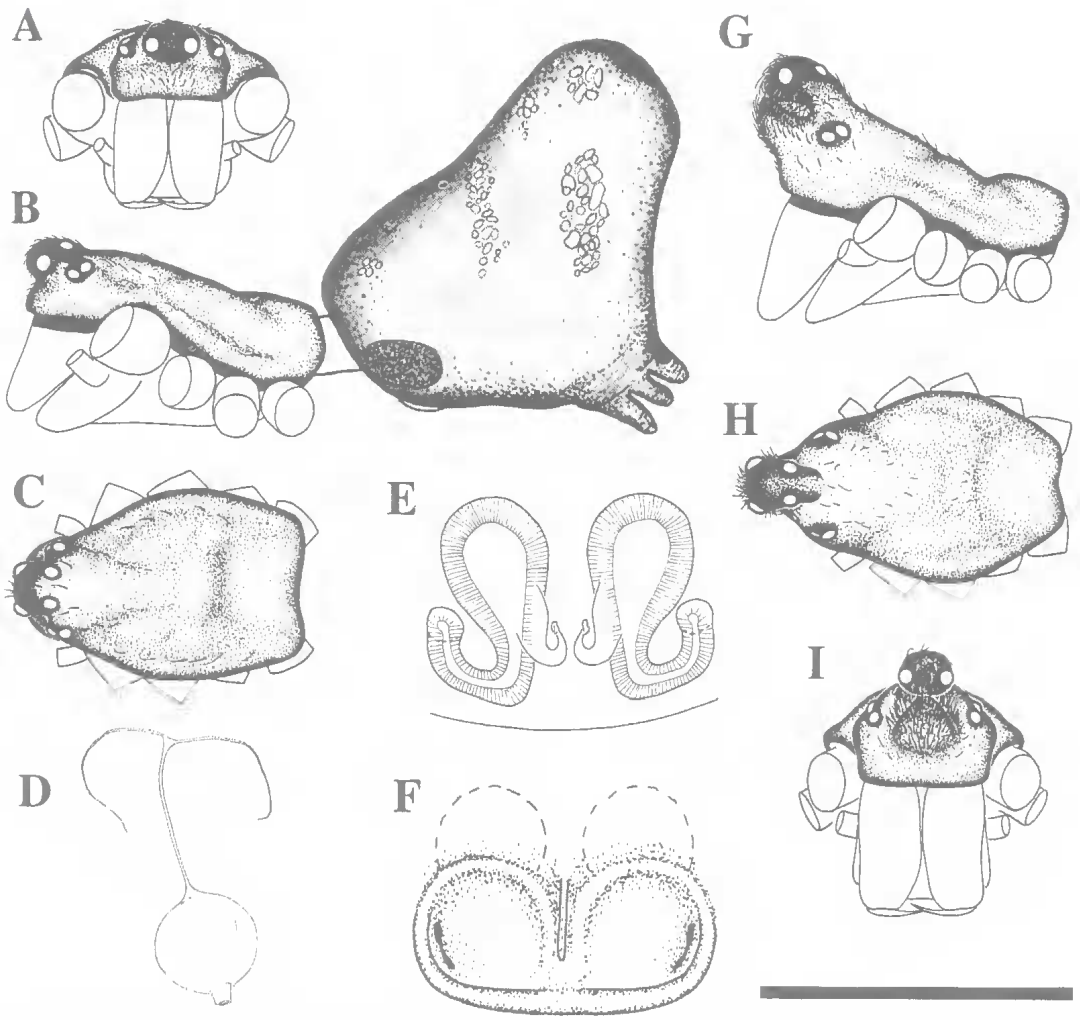

FIG. 4. *A. miniaceus*. A-C, female cephalothorax and abdomen; D, egg sac; E, spermathecae and fertilisation ducts; F) epigyne; G-I, male cephalothorax. Scale bars: A-C, G-I = 2.0mm; D = 13.9mm; E, F = 0.495mm.

morphology between *A. antipodianus* and *A. argentatus*, as the epigynes of *A. argentatus* (Sri Lanka, HEC) were covered with a resinous accretion (also see Levi et al., 1982). None of the Australian male specimens that I examined (including ones from far north Queensland, AM, QM) belong to *A. argentatus*.

Argyrodes miniaceus (Doleschall, 1857) (Figs 2B, 4A-I)

Theridion miniaceum Doleschall, 1857: 408 (first synonymised by Thorell, 1878).
Argyrodes miniaceus: Thorell, 1878: 138; Berland, 1938: 162; Bonnet, 1957: 715; Chrysanthus, 1963: 739, fig. 63-66, 69; Chikuni, 1989: 177, fig. 22; Platnick, 1987: 192; Platnick, 1991: 191.
Argyrodina miniacea Roewer, 1942: 433.
Argyrodes walkeri Rainbow, 1902: 524, plate 28, figs 2,3 (first synonymised by Berland, 1938).
A. musgravei Rainbow, 1916: 52, plate 15, fig. 28 (new synonymy).

MATERIAL. HOLOTYPE: *A. musgravei* Rainbow, 1916, F, Gordonvale, Qld, Australia (AM). *Theridion miniaceum* Doleschall, 1858, (TYPE), juv. F, Amboina (NHMW). *A. walkeri* Rainbow, 1902, (TYPE), F, Torres I., Torres Strait, Australia (AM). OTHER MATERIAL: AMKS8257, M, F, juv., Cattle Co. Headquarters, Jimi R. (PNG), 05°18'S, 144°14'E; AMKS35057, F, Honiara (Solomon Is), 09°28'S, 159°57'E. Queensland - AMKS49156, M, Mossman, 16°28'S, 145°28'E; AMKS49161, F, Cooktown, 15°28'S, 145°15'E; QMS29822, M, QMS29824, F, Freshwater Ck, Cairns, 16°56'S, 145°42'E; QMS29831, M, QMS29834, F, QMS29836, F, Centenary Lks, Cairns, 16°55'S,

145°46'E; QMS29865, M, F, Carlisle I., 20°47'S, 149°17'E; QMS29866, M, Canal Ck road crossing, Cape York, 11°25'S, 142°23'E; QMS29872, M, F, Bundaberg Forest, 24°52'S, 152°21'E, QMS29879, F, Jardine R., Cape York, 11°09'S, 142°22'E; QMS29883, F, Normanby Stn, 80km NW Cooktown, 15°23'S, 144°52'E; QMS29884, F, Horn I., Torres Strait, 10°37'S, 142°17'E; QMS29886, M, F, Tanners Ppty, Cooktown, 15°30'S, 145°22'E; QMS29890, F, Prince of Wales I., Torres Strait, 10°41'S, 142°09'E; QMS29891, M, F, Jardine R., Cape York, 11°09'S, 142°22'E; QMS29892, 2M, 2F, Port Stewart, 14°04'S, 143°41'E; QMS46514, F, QMS46518, F, QMS46565, M, QMS46566, M, North Stradbroke I., 27°35'S, 153°27'E; QMS46519, F, Pinkenba, 27°25'S, 153°07'E; QMS46520, F, QMS46578, M, The Gap, Brisbane, 28°27'S, 153°01'E; QMS46521, F, Cairns, 16°55'S, 145°46'E; QMS46523, F, QMS46525, F, QMS46570, M, QMS46572, M, Yeppoon, 23°08'S, 150°45'E; QMS46526, F, QMS46574, M, QMS46576, M, Cairns, 16°55'S, 145°46'E. Northern Territory - QMS29873, F, West Alligator R. mouth, 12°12'S, 132°13'E; QMS29874, M, juv., Kemp Airstrip, 12°35'S, 131°20'E; QMS29875, 2M, 2F gorge NE of Mt Gilruth, 13°02'S, 133°05'E; QMS29876, 2M, 2F, QMS29885, F, Radon Ck., 12°45'S, 132°53'E; QMS29877, F, juv., East Alligator R. crossing, 12°25'S, 132°58'E.

DIAGNOSIS. Combination of male carapace, male palp and epigyne morphologies is diagnostic among SE Queensland species. ALE and PLE of males below base of cephalic projection (Fig. 4G,I) (similar to *A. antipodianus*), but unlike all species, clypeal and cephalic projections touch distally (but not centrally, e.g. *A. rainbowi*) (Fig. 4G). Extension of median apophysis relatively broad and convex distally, embolus short and claw-like (Fig. 2B). Fossae large and closely-spaced, almost touching (similar to *A. fissifrons*), but spherical (not reniform, e.g. *A. fissifrons*), with slit-like gonopores (Fig. 4F). Insemination duct short (Fig. 4E), unlike *A. rainbowi*, *A. kulczynskii* or *A. fissifrons*.

DESCRIPTION. *Male*. Total length 3.88-4.56 (n=6). CL 1.80-2.3, CI 1.61-1.90. AL 1.92-2.2, AI 1.22-2.00, AH 1.40-2.24. Palp 2.72-2.88, leg I 11.84-16.52, leg II 7.12-10.60, leg III 4.04-5.92, leg IV 6.68-9.60. Leg formula 1243. Cymbium length ca. 0.8, width ca. 0.5.

Colour of carapace orange except for cephalic projection and area surrounding ALE and PLE (brown); sternum and palp orange, cymbium brown; legs brown, often orange on distal femora. Tarsi of leg IV pale yellow; abdomen as for female (see below), except lighter ventrally, silver dorsal pattern usually reduced to two pairs of lateral spots, and a black spot present posterior to base of spinnerets.

Abdomen triangular, dorsal tip not extending posterior to spinnerets.

Female. Total length 3.72-6.56 (n=11). CL 1.72-2.08, CI 1.41-1.73. AL 1.84-4.52, AI 1.09-1.48, AH 2.00-4.20. Palp 1.48-1.88, leg I 13.12-16.12, leg II 8.04-9.480, leg III 4.68-5.48, leg IV 7.68-8.80. Leg formula 1243. Epigyne width ca. 0.6.

Colour of carapace orange, dark brown around AME and between ALE and PLE; legs dark brown/black, except for base and for tarsi of leg IV (orange); palps and sternum orange; abdomen light grey-orange dorsally, large black spot on apex, four lateral silver patches near the posterio-dorsally, sometimes with two lateral silver spots anterio-dorsally (Fig. 4B); ventral abdomen brown. Colour of melanic specimens: abdomen black (with silver patches); carapace, palps and chelicerae orange-brown; sternum and legs dark brown, except for tarsus IV (pale yellow).

Carapace relatively wide (see CI). Abdomen conical/triangular, apex broad.

Egg sac chamber spherical, ca. 5.5 long, 5 wide; exit hole relatively narrow (Fig. 4D).

DISTRIBUTION AND ABUNDANCE. Japan (Chikuni, 1989), Australia (Rainbow, 1902, 1916), Amboina (Doleschall, 1857; Thorell, 1878), Papua New Guinea (Chrysanthus, 1963), India (Chrysanthus, 1963).

In eastern Australia, *A. miniaceus* is probably restricted to sub-tropical and tropical habitats, from Brisbane to the Torres Strait islands (Fig. 1A). Specimens have also been collected from coastal Northern Territory, as far west as Kemp Airstrip (12°35'S, 131°20'E). In southeast Queensland, I rarely found adults between May and October, but in tropical Queensland, the species appears common throughout the year. In southeast Queensland, this spider can be fairly abundant in rainforest pockets of North Stradbroke Island (27°28'S, 153°28'E). Melanic individuals can be found throughout the species range in Queensland.

REMARKS. Conspecificity of the Australian material with the juvenile female from NHMW was established by the overall shape and size. More accurate comparisons were made with the type of *A. walkeri* (synonymised by Berland, 1938) from AM. Several authors (including Chrysanthus, 1963) provide good illustrations of the epigyne, male carapace and palp. However,

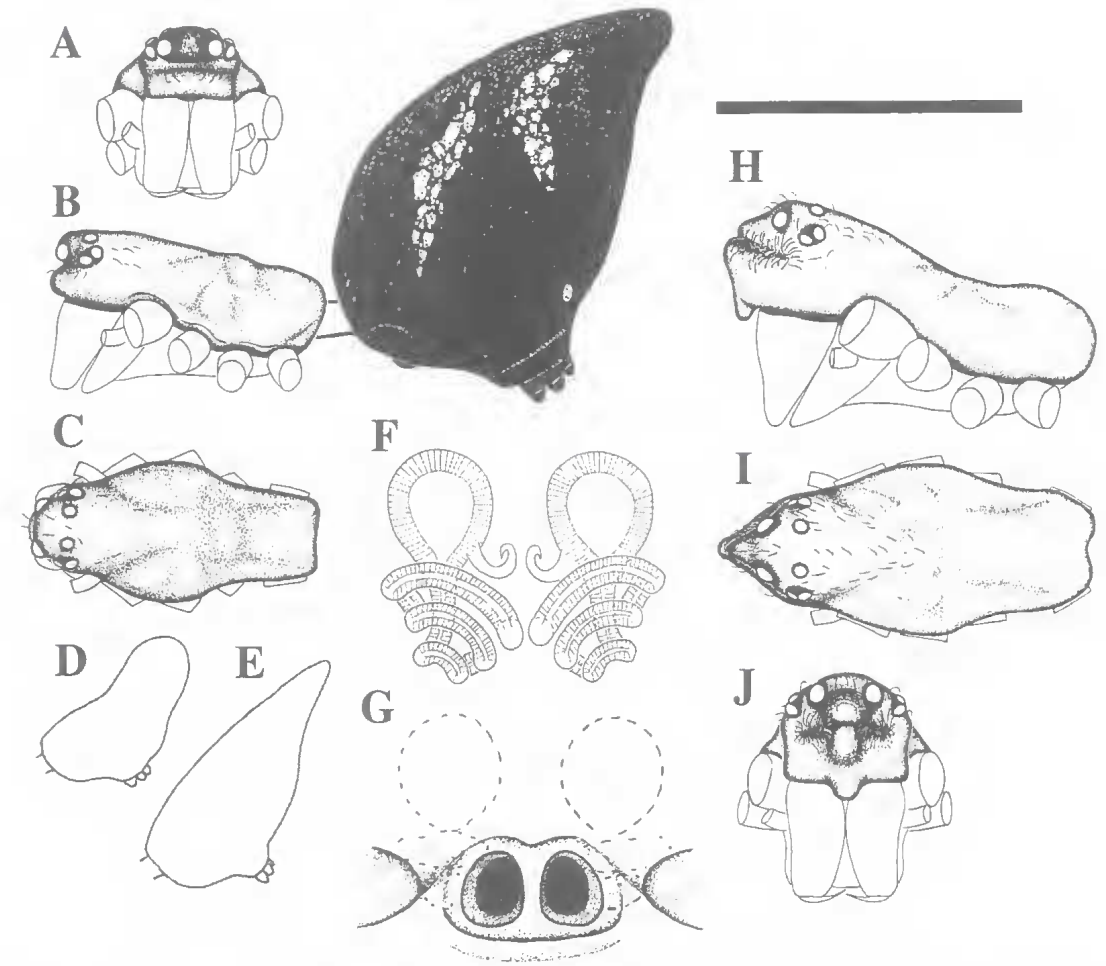

FIG. 5. *A. rainbowi*. A-C, female cephalothorax and abdomen; D, E, variation in shape of female abdomen; F, spermathecae and fertilisation ducts; G, epigyne; H-J, male cephalothorax. Scale bars: A-C, H-J = 1.2mm; D, E = 2.5mm; F, G = 0.320mm.

the descriptions in Thorell (1881: 161), Berland (1938: 162, figs 93, 94), Chen & Zhang (1991: 152, fig. 148.1-3), Chrysanthus (1975: 43) and Yaginuma (1978: 51, fig. 28.1) were insufficient to ascertain if their material is conspecific, and I did not examine their specimens.

Argyrodes rainbowi (Roewer, 1942)
(Figs 2C, 5A-J)

A. argentata Rainbow, 1916: 50, pl. 15, fig. 24 (preoccupied by *A. argentata* Pickard-Cambridge, 1880).
Argyrodina rainbowi Roewer, 1942: 435. Replacement name for *A. argentata*.

MATERIAL. TYPE: *A. argentata* Rainbow, 1916, F, Gordonvale, Qld, Australia (AM). OTHER MATERIAL. New South Wales - AMKS18404, M, F, Blackbutt Reserve, Newcastle, 33°18'S, 151°19'E; AMKS18820, M, F, Reids Flat, Royal National Pk, 34°08'S, 151°04'E; AMKS44791, M, F, Calga, 33°25'S, 151°13'E; AMKS49163, M, F, North Ryde, 33°48'S, 151°06'E; AMKS49170, M, F, Pittwater, 33°38'S, 151°18'E; QMS29888, M, Cudgen, 28°16'S, 153°33'E; QMS29894, 3M, 2 F, Turners Dip, 31°01'S, 152°42'E; QMS46552, 3M, Sydney, 33°53'S, 151°13'E. Queensland - QMS29825, juv., QMS29826, M, QMS29827, F, QMS29828, M, Forty Mile Scrub, 18°05'S, 144°51'E; QMS29845, M, 2F, Mt Coolum, 26°34'S, 153°05'E; QMS29867, 2M, 2F, Lk Broadwater via Dalby, 27°21'S, 151°06'E; QMS29869, 2 M, F, Blackdown Tbld, via Dingo, 23°50'S, 149°03'E; QMS29870, M, 2F, Bundaberg Forest, 24°52'S, 152°21'E; QMS29881, M, 2F, Blue Lagoon area, Moreton I., 27°11'S, 153°24'E; QMS29889, F, Camp Milo, Cooloola, 26°00'S, 153°05'E; QMS29897, M, Coen, 13°56'S, 143°12'E; QMS29900, M, Black Mt, 16°39'S, 145°29'E; QMS29905, 2M, 2F, Davies Ck, 16°55'S, 145°32'E; QMS46498, M,

QMS46550, F, QMS46557, 3M, 2F, QMS46558, 2F, Pinkenba, 27°26'S, 153°07'E; QMS46499, M, QMS46506, M, QMS46539, M, QMS46541, F, QMS46543, F, QMS46555, 3M, 3F, Nathan, Brisbane, 27°33'S, 153°03'E; QMS46547, F, QMS46548, F, Chapel Hill, Brisbane, 27°28'S, 153°03'E; QMS46500, M, QMS46507, M, QMS46554, M, F, North Stradbroke I., 27°35'S,153°27'E.

DIAGNOSIS. Male carapace and palp morphology are diagnostic. Unlike for remaining species (except *A. kulczynskii*, which appears closely related) cephalic and clypeal projections touch throughout their length (Fig. 5H-J), all eyes situated on cephalic projection, palpal embolus elongated and filiform (Fig. 2C). Lower frontal carapace, above base of chelicerae, with discrete ventrally-oriented notch (Fig. 5H,J) unlike *A. kulczynskii*, whose antero-ventral carapace is pointed and beak shaped. Also, base of embolus tear-shaped and almost globular for *A. kulczynskii* (Chrysanthus, 1963), but more angular and flat for *A. rainbowi* (Fig. 2C). *Argyrodes neocaledonicus* Berland, 1924 (albeit not recorded from Australia) is also similar in morphology and colour. However, male *A. neocaledonicus* has no notch on antero-ventral carapace and its cephalic projection is more rounded from dorsal aspect (Berland, 1924) than for *A. rainbowi*.

Epigyne small (see below) with oval, closely-spaced fossae, and shallow, oval indentations extending laterally from fossae (Fig. 5G). Unlike for remaining species (except *A. kulczynskii*), the insemination duct shows extensive coiling. However, insemination duct of *A. kulczynskii* is more coiled (5 times) than for *A. rainbowi* (3 times, Fig. 4F).

DESCRITPION. *Male*. Total length 2.80-3.80 (n=12), CL 1.32-1.60, CI 1.81-2.06, AL 1.52-2.20, AI 1.36-2.29, AH 1.12-1.96. Palp 1.20-1.46, leg I 9.12-13.76, leg II 3.92-5.88, leg III 1.80-2.44, leg IV 2.64-3.64. Leg formula 1243. Cymbium length ca. 0.5, width ca. 0.3.

Colour of carapace, sternum, legs and abdomen as for female (see below); anterior latero-dorsal silver patch on abdomen often longer than posterior patch. In two specimens, a small, transverse, dull-silver band on ventral abdomen, between spinnerets and tip. Cymbium usually black.

Abdomen narrow, elongated, triangular, dorsal tip slightly behind spinnerets.

Female. Total length 2.36-3.80 (n=14). CL 1.08-1.28, CI 1.69-2.07, AL 1.32-2.40, AI 1.05-1.95, AH 1.48-3.00. Palp 0.76-0.96, leg I 6.60-8.88, leg II 2.76-3.72, leg III 1.40-1.72, leg IV 2.08-2.60. Leg formula 1243. Epigyne width ca. 0.3.

Colour of carapace, sternum and palps dark brown, legs sometimes lighter; abdomen black or dark brown, usually with two oblique, elongated, silver patches on each side (Fig. 5B). Shape and relative size of silver patches variable; anterior patches may extend ventrally to epigyne, or be interrupted, irregular, faded, or absent; sometimes, anterior and posterior patches form a continuous pattern. Two lateral, silver spots behind spinnerets, one central spot between spinnerets and epigyne, another central spot or short stripe (sometimes absent) behind abdominal apex.

Carapace relatively narrow (see CI). Abdomen usually tear drop-shaped (but shape may vary: Fig. 5D, E), apex usually extends slightly behind spinnerets (Fig. 5B).

Egg sac unknown.

DISTRIBUTION AND ABUNDANCE. Found throughout much of the eastern Australian coast, from warm, temperate habitats (e.g. Sydney, NSW) to tropical Queensland (Fig. 1B). In southeast Queensland, adults can be collected throughout the year.

REMARKS. Abdomen of the female type (=*A. argentata*, Rainbow, 1916; AM) is slightly higher than that of most specimens that I examined. However, abdominal shape is quite variable for this and many other species of *Argyrodes* (Exline & Levi, 1962, figs 3D-E, 5D-E, 6J-K; pers. obs.). I could not distinguish the epigyne morphology of the type specimen from other examined *A. rainbowi*. Further, collection locality of the type (Gordonvale, 17°06'S, 145°47'E) is proximate to the geographic range of specimens that I examined (e.g. Forty Mile Scrub, 18°05'S, 144°51'E; QM).

Several specimens collected in far north Queensland (QM) closely resemble *A. rainbowi* except that the lower frontal part of the male carapace is straight, without a notch (see Diagnosis), and is not beak-shaped (*A. kulczynskii*). These resemble *A. neocaledonicus* (see Berland, 1924).

Argyrodes alannae sp. nov.
(Figs 2D, 6A-K)

MATERIAL. HOLOTYPE: QMS35686, M, Nathan, Brisbane, Qld, 27°33'S, 153°03'E, Oct 95, P. Grostal, in dry sclerophyll forest, from web of *Cyrtophora moluccensis* Doleschall. OTHER MATERIAL: Victoria-

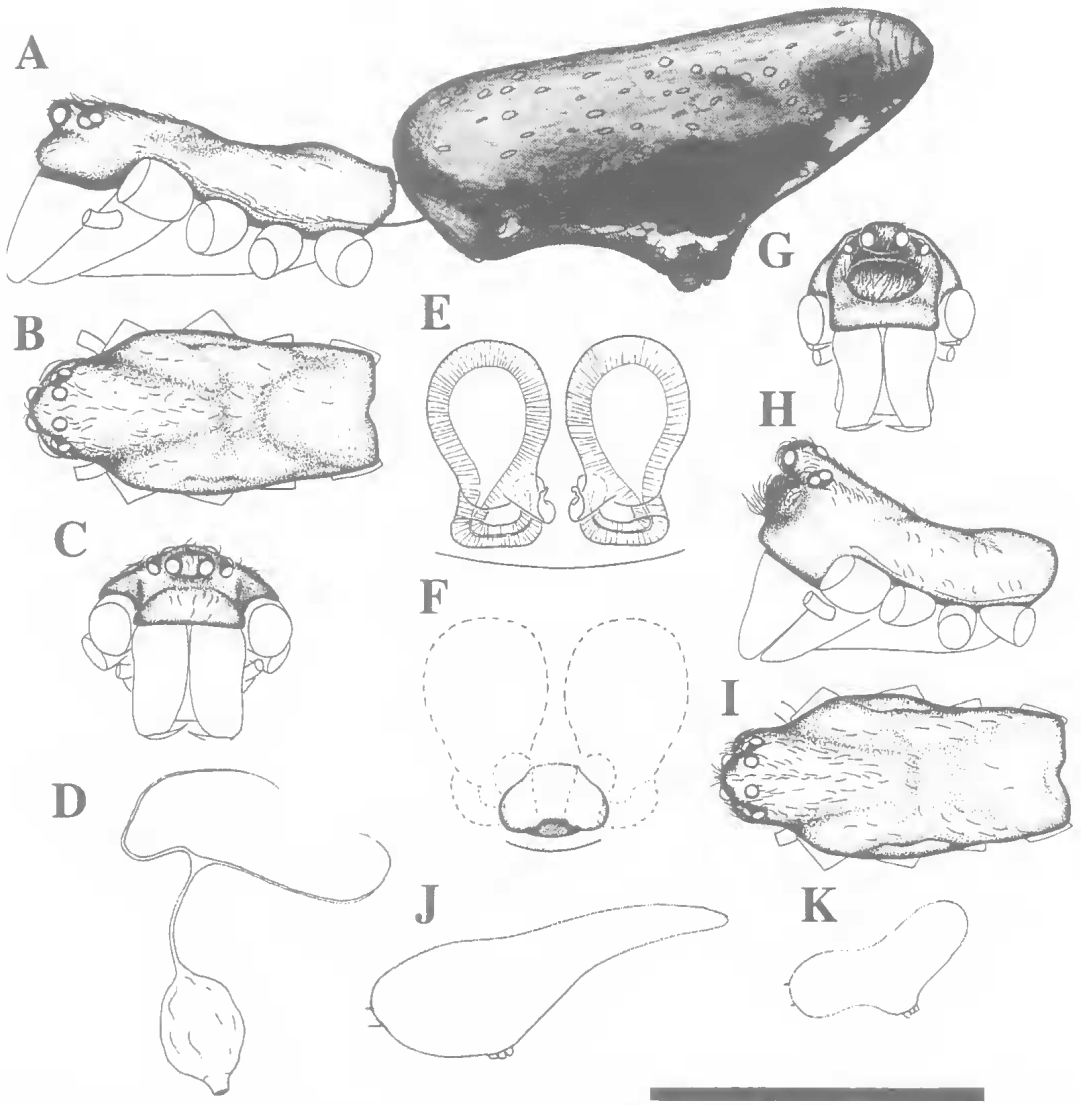

FIG. 6. *A. alannae* sp.nov. A-C, female cephalothorax and abdomen; D, egg sac; E, spermathecae and fertilisation ducts; F, epigyne; G-I, male cephalothorax; J, K, variation in shape of female abdomen. Scale bars A-C, G-I = 1.7mm; D = 21.4mm; E, F = 0.368mm; J, K = 12.6mm.

QMS35702, M, QMS35717, 2F, Edithvale. Tasmania - AMKS31178, M, Lindisfarne, 42°51'S, 147°21'E; AMKS31180, F, Opossum Bay, 42°59'S, 147°24'E; AMKS31346, M, juv., East Risdon, 42°50'S, 147°21'E; AMKS31347, M, F, Punch Bowl, 41°27'S, 147°10'E; AMKS31348, M, F, Trevallyn, Launceston, 41°27'S, 147°10'E. New South Wales - AMKS49164, M, F, Currawong, Broken Bay, 33°36'S, 151°18'E; AMKS49173, M, F, QMS35701, M, QMS35716, F, Sydney, 33° 53'S, 151° 13'E. Queensland - AMKS12820, F, Mt Dryander, via Prosperine, 20°15'S, 148°32'E; AMKS49162, F, Fraser I., 25°33'S, 152°59'E; QMS29838, M, Millstream Falls, 17°43'S, 145°26'E; QMS29843, F, QMS29863, 2F, QMS29882, M, F, Rochedale, Brisbane, 27°37'S, 153°09'E; QMS29853, 2M, 2F, Lk Nuga Nuga, 24°59'S, 148°40'E; QMS29857, M, F, juv., Koah Rd, 16°49'S, 145°31'E; QMS29858, 2F, 2 juv., Tinaroo, 17°10'S, 145°35'E; QMS29864, M, Wolfram, 17°05'S, 144°57'E; QMS29868, M, Blackdown Tbld, via Dingo, 23°50'S, 149°03'E; QMS29871, 2M, 2F, Bundaberg Forest, 24°52'S, 152°21'E; QMS29893, F, Homevale, 21°24'S, 148°33'E; QMS29898, M, 2F, Mt Garnet, 17°41'S, 145°07'E; QMS29903, 2M, 2F, Davies Ck, 16°55'S, 145°32'E; QMS29844, F, Mt Coolum, 26°34'S, 153°05'E; QMS35687, M, QMS35688, M, QMS35689, M,

QMS35690, M, QMS35691, M, QMS35692, M, QMS35693, M, QMS35697, M, QMS35698, M, QMS35699, M, QMS35703, F, QMS35704, F, QMS35705, F, QMS35706, F, QMS35707, F, QMS35708, F, QMS35710, F, QMS35712, F, QMS35714, F, QMS35715, F, Nathan, Brisbane, 27°33'S, 153°03'E; QMS35695, M, QMS35696, M, QMS35709, F, QMS35713, F, Chapel Hill, Brisbane, 27°28'S, 153°03'E; QMS35700, M, Gladstone, 23°51'S, 151°16'E; QMS35711, F, Pinkenba, Brisbane, 27°26'S, 153°07'E.

ETYMOLOGY. For Alanna.

DIAGNOSIS. Palp and cephalothorax of male *A. alannae* are diagnostic. Extension of median apophysis broad and tongue-like distally; embolus broad and evenly-tapering (Fig. 2D). Clypeal projection conspicuous, but shorter and broader relative to cephalic projection (Fig. 6G,H) than for remaining species (except for *A. fissifrons*). However, clypeal projection is pointed for *A. fissifrons* (Fig. 7H, I), but rounded for *A. alannae* (Fig 6G, H). ALE and PLE of *A. alannae* at base of cephalic projection (Fig. 6H), unlike for *A. antipodianus*, *A. miniaceus* or *A. rainbowi*. *Argyrodes wolfi* Strand (illustrated by Chrysanthus, 1975: 41, figs 160-164) also appears similar to *A. alannae* (see *A. fissifrons*: Diagnosis). However, for males, clypeal projection of *A. wolfi* is relatively long and parallel to cephalic projection; clypeal projection of *A. alannae* is shorter and distally diverging from cephalic projection (Fig. 6H). Female *A. alannae* can be separated by epigyne morphology. Gonopores of *A. alannae* are hidden under thick, trapezoid, upraised plate (Fig. 6F).

DESCRIPTION. *Male (Holotype)*. Total length 5.20. CL 1.82, CI 1.92. AL 3.46, AI 3.10, AH 1.24. Palp 2.42, leg I 11.50, leg II 7.60, leg III 4.10, leg IV 5.80. Leg formula 1243. Cymbium length ca. 0.8, width ca. 0.5.

Colour of cephalothorax dark brown, anterio-ventral part of cephalic projection almost black; palps and four proximal segments of leg I brown; otherwise, legs yellowish-brown, darker near patellae and tibial-metatarsal joints; cymbium dark brown. Abdomen dark grey, almost black, with two light spots on the posterior tip; laterally, a light line extending from spinnerets towards apex, then curving dorso-anteriorly, with several other light patches along latero-ventral surfaces; ventrally, longitudinal dark brown band with several light spots posteriorly; two parallel, longitudinal light patterns often extending latero-ventrally, joined by a posterio-ventral lateral crescent. Abdomen elongated, approx. triangular, with narrow, rounded apex; spinnerets horizontally half way between apex and pedicel.

Other Males. Often with dorsal, dull white spots on abdomen, less dense or prominent than for female. Abdominal apex is mobile and extendible, in some specimens appearing bulbous or slightly pointed (see below).

Female. Total length 5.09-8.04 (n=13). CL 1.53-2.04, CI 1.71-2.17. AL 3.27-6.83, AI 1.88-3.76, AH 1.02-2.84. Palp 1.24-1.67, leg I 9.16-13.59, leg II 5.89-8.51, leg III 3.48-4.94, leg IV 4.94-8.43. Leg formula 1243. Epigyne width ca. 0.2.

Colour of cephalothorax brown, darker around AME and around ALE and PLE. Chelicerae and palps brown (the latter sometimes yellowish); legs light yellowish-brown, darker near patellae and tibial-metatarsal joints; abdomen mostly reddish- or olive-brown; darker (almost black) latero-ventrally, towards apex, usually lined with a white patch pattern of variable shape and thickness (Fig. 6A); often, a small, oblique, white crescent towards abdominal tip; sometimes, abdominal colour more uniform and pattern less conspicuous; ventral abdomen reddish brown, often forming a wide longitudinal stripe with two or three curved transverse white lines posterior to spinnerets; many light speckles laterally and dorsally, either prominent or dull/inconspicuous (but always visible in fresh specimens).

Carapace relatively flat and elongated (see CI). Abdomen elongated, spinnerets often half way between pedicel and apex (Fig. 6A), their position variable depending on extension of abdomen. Abdomen (including the tip) may be long and fully extended (well fed or gravid females), or short, with a retracted tip (Fig. 6J,K). Apex mobile, sometimes curling anterio-dorsally. Medial part of abdomen dorso-ventrally flattened in several specimens (Fig. 6K).

Egg sac chamber large, urn-shaped, slightly elongated, ca. 9 long, 6 wide (Fig. 6D); exit hole relatively narrow.

DISTRIBUTION AND ABUNDANCE. This species has an extensive climatic range, occurring throughout the eastern Australian coast (Fig. 1B) from cool, temperate areas (e.g. Opossum Bay, Tasmania) to tropical Queensland (e.g. Davies Ck). In southeast Queensland, adults may be found throughout the year, but appear most numerous between October and May. Specimens from Tasmania, Melbourne and Sydney were also collected between these months.

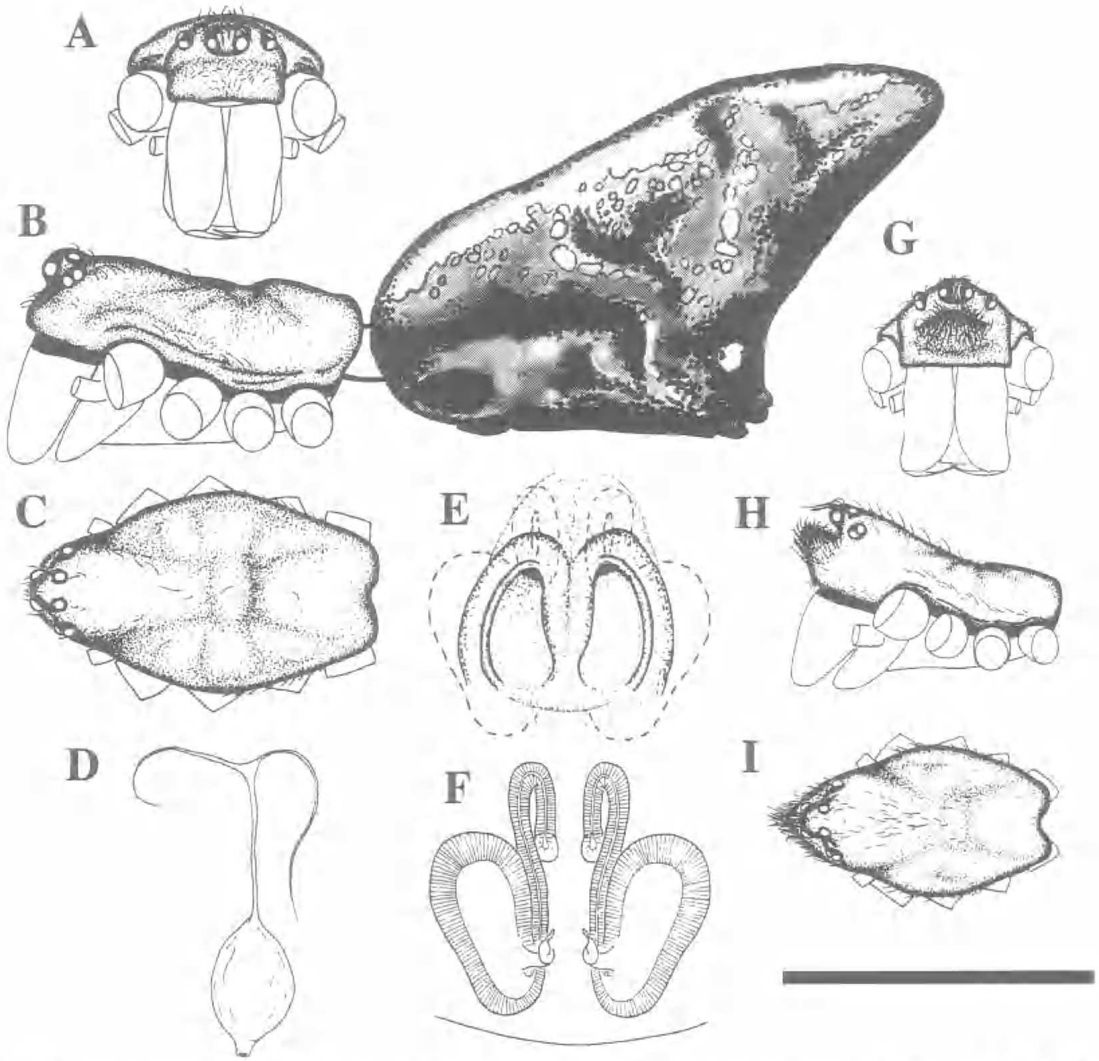

FIG. 7. *A. fissifrons*. A-C, female cephalothorax and abdomen; D, egg sac; E, spermathecae and fertilisation ducts; F, epigyne; G-I, male cephalothorax. Scale bars: A-C, G- I = 2.7mm; D = 24.9mm; E, F = 0.592mm.

Argyrodes fissifrons
Pickard-Cambridge, 1869
(Figs 2E, 7A-I)

A. fissifrons Pickard-Cambridge, 1869: 380, pl. 12, fig. 31-38; Thorell, 1878: 145; Pickard-Cambridge, 1880: 329, pl. 29, fig. 8a; Bonnet, 1957: 711; Chrysanthus, 1963: 737, figs 55-58; Levi et al., 1982: 106, fig. 1; Chikuni, 1989: 34, fig. 23; Platnick, 1991: 191.
Argyrodina fissifrons Roewer, 1942: 432.
A. procrastinans Pickard-Cambridge, 1880: 330, pl. 29, fig. 9 (first synonymised by Thorell, 1895).

MATERIAL. TYPE: *A. fissifrons* Pickard-Cambridge, 1869, (POSSIBLE TYPES, see Remarks), F's, egg sacs, Sri Lanka, leg. Thwaites (HEC). *A. procrastinans* Pickard-Cambridge, 1880, (POSSIBLE TYPE, see Remarks), F, Bombay, leg. Hobson (HEC). OTHER MATERIAL. HEC, F's, Amboina, 1878, leg. Thorell. Northern Territory - QMS29842, F, West Alligator R. mouth, 12°11'S, 132°16'E; QMS29852, M, F, juv., gorge NE of Mt Gilruth, 13°02'S, 133°05'E. Queensland - AMKS49155, F, Mossman, 16°28'S, 145°28'E; AMKS49157, M, Edmonton, 17°01'S, 145°45'E; AMKS49160, M, F, Wolfram, 17°05'S, 144°57'E; QMS29821, F, juv., QMS29832, M, QMS29833, F, QMS29835, F, Centenary Lks, Cairns, 16°55'S, 145°46'E; QMS29829, M, QMS29830, F, QMS46533, M, Cairns, 16°55'S, 145°46'E; QMS29841, F, Bundaberg Forest, 24°52'S, 152°21'E; QMS29849, 3M, F, Dulhunty R., 12°00'S, 142°07'E; QMS29851, F, Moreton I., 27°11'S, 153°24'E; QMS29854, M, F, Moreton I., 27°05'S, 153°26'E; QMS29856, M, Koah Rd, 16°49'S,

145°31'E; QMS29860, M, Kuranda, 16°49'S, 145°38'E; QMS29880, 2F, Mt Molloy, 16°41'S, 145°20'E; QMS29901, M, F, QMS29902, M, Black Mt., 16°39'S, 145°29'E; QMS46529, M, QMS46531, M, QMS46585, F, QMS46594, 3F, juv., Nathan, Brisbane, 27°33'S, 153°03'E; QMS46532, M, QMS46534, M, QMS46588, F, QMS46589, F, Pinkenba, 27°25'S, 153°07'E; QMS46535, M, QMS46579, F, Chapel Hill, Brisbane, 27°28'S, 153°03'E; QMS46595, 4F, juv., North Stradbroke I., 27°35'S, 153°27'E; QMS46596, F, juv., Yeppoon, 23°08'S, 150°45'E.

DIAGNOSIS. Males can be separated by cephalothorax and palp morphology. Unlike for other species, clypeal projection pointed, almost conical (Fig. 7G-I), cephalic projection with tuft of long, forward-pointing setae (Fig. 7H). ALE and PLE at base of cephalic projection, unlike for *A. antipodianus*, *A. miniaceus*, *A. rainbowi* and *A. kulczynskii*. Extension of median apophysis wide and curved distally; embolus narrow and short; conductor broad and flask-shaped (Fig. 2E). Female *A. fissifrons* are larger (>8.5mm body length) than females of remaining species (<8mm long). Large, reniform fossae (Fig. 7E) and long, u-shaped insemination ducts (Fig. 7F) are diagnostic for females.

A species similar to *A. fissifrons* (also resembling *A. wolfi* Strand) is found in north Queensland (QM), but clypeal projection of males is rounded, not pointed. For females, epigyne is much smaller than for *A. fissifrons*, with round (not reniform) fossae.

DESCRIPTION. *Male*. Total length 4.94-6.83 (n=8). CL 1.82-3.13, CI 1.67-1.83. AL 2.55-3.85, AI 2.00-2.56, AH 1.31-2.47. Palp 3.49-4.65, leg I 14.76-24.43, leg II 9.31-15.99, leg III 5.38-9.31, leg IV 9.16-15.56. Leg formula 12(=)43 (relative lengths of legs 2 and 4 may vary slightly, but are approximately equal in almost all specimens that I examined). Cymbium length ca. 0.8, width ca. 0.5.

Colour of cephalothorax, palps and legs orange/orange-brown. Legs sometimes darker near patellae and towards distal sections of tibiae. Abdomen grey-orange to brown, with silver speckling (but less numerous than for female). Transverse or oblique curved patterns formed by silver speckling and brown patches. Often two lateral light spots posterior to spinnerets, sometimes inconspicuous on shrunk or lightly coloured abdomens. Abdomen shape similar to that of female (see below).

Female. Total length 8.51-11.34 (n=12). CL 2.55-3.34, CI 1.60-1.83. AL 5.31-7.99, AI 1.70-2.81, AH 2.69-5.31. Palp 2.04-2.55, leg I 21.74-27.34, leg II 14.54-17.74, leg III 8.94-10.25, leg IV 16.14-19.48. Leg formula 1423. Epigyne width ca. 0.7.

Colour of cephalothorax orange to orange-brown, darker around ALE and PLE; palps and legs as for male. Abdomen from grey-orange, to orange and brown, darker ventrally; relatively dense, conspicuous speckling of silver spots (esp. dorsally), forming long, curving patterns laterally. Often, dark brown, elongated patterns on lateral sections of abdomen (Fig. 7B). Ventrally, posterior to spinnerets, two large, lateral light spots with dark perimeter.

Abdomen elongated, extending beyond spinnerets, but relatively wide and high (Fig. 7B); central part may be dorso-ventrally flattened. Two lateral thickenings near apex. Tip often pointed, but as for *A. alannae* (Fig. 6J), it may be retracted and appear bulbous; apex probably not mobile, as it was not curled for any of the examined specimens (see *A. alannae*). Spinnerets about half way between pedicel and apex; position less variable than for *A. alannae* (Fig. 6J,K). Epigyne oval, well sclerotised.

Egg sac as for *A. alannae* (Fig. 6D), but slightly larger ca. 11 long, 7 wide (Fig. 7D).

DISTRIBUTION AND ABUNDANCE. Amboina (Pickard-Cambridge, 1880), Sri Lanka (Pickard-Cambridge, 1869; 1880), Japan (Chikuni, 1989), Papua New Guinea (Levi et al., 1982).

In eastern Australia, specimens were taken throughout subtropical and tropical coastal regions (Fig. 1B), from Brisbane to Dulhunty R. (north Qld). The species has also been collected from coastal Northern Territory (e.g. Mt Gilruth). In southeast Queensland, I collected adults between December and May, while specimens from tropical regions were collected throughout the year.

REMARKS. The present location of the types of *A. fissifrons* is in doubt. Chrysanthus (1963, 1975) and Levi et al. (1982) noted that the type is in the Natural History Museum (London), but P. Hillyard (curator) did not locate it there. I am uncertain if the examined Sri Lankan specimens from HEC include the type of *A. fissifrons*. The material consists of a series of adults and egg sacs, (as in original description) but the collector name (Thwaites) is different from that in the original description (Nietner). Possibly, the collector details are a lapsus by Pickard-Cambridge (I. Lansbury, pers. comm.).

Conspecificity was established between the specimens from Queensland and Pickard-Cambridge's material from Sri Lanka and Amboina on the basis of palp and carapace morphology of males, and by the epigyne. I could not establish a difference between the specimen of *A. procrastinans* from Bombay (HEC) and my material (although the holotype of *A. procrastinans* is not designated, the sex (F), locality and collector details (J. Hobson) of the specimen agree with the original description).

Previous publications show contrasting illustrations of *A. fissifrons*. Illustrations by Chrysanthus (1975: 41, figs 156-159) of epigynes from Papua New Guinea material show insemination ducts that are wider (relative to spermathecae) and shorter than those of the specimens described here. The drawing of the epigyne of *A. fissifrons* by Levi et al. (1982) shows relatively short, simple insemination ducts. The authors did not provide a description of their material, except for comments on the resinous accretion covering the epigyne. Illustrations provided by Feng (1990: 90, figs 1-5) show the insemination ducts following a zig-zag, rather than a U-shaped (Fig. 7F) path. Further, the fossae illustrated by Feng are directed towards each other (forming a heart-shape), rather than being parallel. Thorell (1895: 117) and Yaginuma (1978: 32, pl. 6, fig. 30) did not provide sufficient information to establish conspecificity and I did not examine their material.

ECOLOGY AND BEHAVIOUR. Behaviourally, *Argyrodes* is a diverse genus, and some species (e.g. *A. colubrinus*) are probably not kleptobiotic (Clyne, 1979; Eberhard, 1979; Mascord, 1980; Elgar, 1993; pers. obs.). In contrast, other species seem highly adapted to a kleptobiotic lifestyle. *Argyrodes antipodianus* can remove prey from host webs using complex techniques that include attaching its own silk threads to a prey item, cutting the prey from the web and swinging with the stolen item away from the host's orb: a behaviour aptly named the 'Tarzan swing' (Whitehouse, 1986). This inquiline can steal prey over 30 times heavier than its own body weight, within less than 20 seconds (pers. obs.). The spider can also feed, apparently undetected, on items that are simultaneously consumed by the host (Whitehouse, 1988). Foraging behaviour of kleptobiotic *Argyrodes* may also depend on the host to kleptobiont size ratio (see Larcher & Wise, 1985). Stealthy food theft may be difficult for relatively large and heavy spiders (e.g. *A. fissifrons*), and the level of direct interaction with the host may increase for these species (Elgar, 1993).

Several species of kleptobiotic *Argyrodes* have been called commensals (Kaston, 1965; Exline & Levi, 1962; Wise, 1982; Bradoo, 1983), as they were thought to remove prey that was small and of little interest to the host. If so, referring to these spiders as 'klepto-parasites' would not be justified (Vollrath, 1984). However, some species (e.g. *A. antipodianus*) can also remove large prey items, otherwise consumed by the host (Whitehouse, 1986; pers. obs.). Negative effects of foraging by kleptobiotic *Argyrodes* are strongly supported by the fact that some species such as *A. antipodianus* can reduce their host's weight gain (Grostal & Walter, 1997). Apart from stealing food, several *Argyrodes* species may consume their host's web (Vollrath, 1987; Shinkai, 1988; Whitehouse, 1986; Grostal & Walter, 1997), itself a nutritious resource (Peakall, 1971; Higgins, 1987; Townley & Tillinghast, 1988; Sherman, 1994). Also, some kleptobionts, including *A. antipodianus* can facultatively prey on the host, especially when the latter is moulting (Lubin, 1974; Smith Trail, 1981; Wise, 1982; Tanaka, 1984; Whitehouse, 1986, 1987; Elgar, 1993).

The degree of colonisation of webs by *Argyrodes* may be determined by the characteristics of these webs. Some webs are frequently colonised, while others rarely, if ever, contain the kleptobionts (Levy, 1985; Whitehouse, 1988; Grostal & Walter, in press). Perhaps some webs may be easier to forage on, or may catch more food (Whitehouse, 1988; Elgar, 1989). Furthermore, host specificity among species of kleptobiotic *Argyrodes* appears to differ. Some species are found on webs of many spiders, while others appear restricted to a narrow range of hosts (Elgar, 1993; pers. obs.). For example, *A. antipodianus* can be found on webs of a wide variety of spiders (Table 1). In contrast, *A. fissifrons* was previously collected from hosts from four families, but in east Queensland I recorded this kleptobiont only from webs of *Cyrtophora* species, even in areas where other potential hosts (e.g. *Nephila* spp.) are more numerous. Reasons for the apparent restriction in host range among different species of *Argyrodes* are still unclear. Perhaps, some species of *Argyrodes* are less efficient at dispersal between webs than others, and are thus restricted to webs that have a high longevity. Also, large and relatively slow-moving

TABLE 1. Host records of five species of kleptobiotic *Argyrodes* from southeast Queensland. * original source taken from Elgar, 1993.

Argyrodes species	Host species (family)	Source
A. antipodianus	*Cambridgea* sp. (Agelenidae)	Whitehouse 1988*
	Badumna longiqua (Amaurobidae)	Whitehouse 1988*
	Araneus dimidiatus (Araneidae)	P. Grostal, pers. obs.
	Argiope sp. (Araneidae)	P. Grostal, pers. obs.
	Cyclosa trilobata (Araneidae)	Whitehouse 1988*
	Cyrtophora hirta (Araneidae)	Elgar et al. 1983, P. Grostal, pers. obs.
	Cyrtophora moluccensis (Araneidae)	P. Grostal, pers. obs.
	Cyrtophora sp. (Araneidae)	P. Grostal, pers. obs.
	Eriophora crassa (Araneidae)	Whitehouse 1988*
	Eriophora pustulosa (Araneidae)	Whitehouse 1988*
	Eriophora transmarina (Araneidae)	P. Grostal, pers. obs.
	Gasteracantha sp. (Araneidae)	P. Grostal, pers. obs.
	Pholcus phalangioides (Pholcidae)	Whitehouse 1988*
	Stiphidion sp. (Stiphidiidae)	Whitehouse 1988*
	Leucauge dromedaria (Tetragnathidae)	Whitehouse 1988*
	Nephila edulis (Tetragnathidae)	Elgar 1989*
	Nephila pilipes (Tetragnathidae)	P. Grostal, pers. obs.
	Nephila plumipes (Tetragnathidae)	P. Grostal, pers. obs.
	Nephilengys sp. (Tetragnathidae)	P. Grostal, pers. obs.
	Phonognatha graeffei (Tetragnathidae)	P. Grostal, pers. obs.
	Achearanea (Theridiidae)	Whitehouse 1988*
	Latrodectus geometricus (Theridiidae)	P. Grostal, pers. obs.
A. rainbowi	*Araneus dimidiatus* (Araneidae)	P. Grostal, pers. obs.,
	Argiope sp. (Araneidae)	P. Grostal, pers. obs.
	Cyrtophora hirta (Araneidae)	P. Grostal, pers. obs.
	Cyrtophora moluccensis (Araneidae)	P. Grostal, pers. obs.
	Eriophora transmarina (Araneidae)	P. Grostal, pers. obs.
	Nephila plumipes (Tetragnathidae)	P. Grostal, pers. obs.
	Phonognatha graeffei (Tetragnathidae)	P. Grostal, pers. obs.
A. miniaceus	*Argiope* sp. (Araneidae)	P. Grostal, pers. obs.
	Nephila pilipes (Tetragnathidae)	Robinson & Robinson 1973*, P. Grostal, pers. obs.
	Nephila plumipes (Tetragnathidae)	P. Grostal, pers. obs.
	Nephilengys sp. (Tetragnathidae)	P. Grostal, pers. obs.
A. alannae	*Cyrtophora hirta* (Araneidae)	P. Grostal, pers. obs.
	Cyrtophora moluccensis (Araneidae)	P. Grostal, pers. obs.
	unidentified sp. (Pholcidae)	P. Grostal, pers. obs.
	Nephila plumipes (Tetragnathidae)	P. Grostal, pers. obs.
	Phonognatha graeffei (Tetragnathidae)	P. Grostal, pers. obs.
	Achearanea sp. (Theridiidae)	P. Grostal, pers. obs.
A. fissifrons	*Agelena limbata* (Agelenidae)	Tanaka 1984*
	Cyrtophora hirta (Araneidae)	P. Grostal, pers. obs.
	Cyrtophora moluccensis (Araneidae)	P. Grostal, pers. obs.
	Cyrtophora sp. (Araneidae)	P. Grostal, pers. obs.
	Linyphia sp. (Linyphiidae)	Tanaka 1984*
	Theridion japonicum (Theridiidae)	Tanaka 1984*
	Philoponella sp. (Uloboridae)	Elgar 1993
	Uloborus varians (Uloboridae)	Tanaka 1984*

kleptobionts such as *A. fissifrons* may be most successful on webs that have a sturdy construction (e.g. *Cyrtophora moluccensis*; pers. obs.), while the relatively small *A. antipodianus* (Whitehouse & Jackson, 1993) may successfully forage on smaller, more delicate webs (e.g. *Argiope* spp., pers. obs.).

Habitat requirements may also vary for different species of *Argyrodes*. For example, *A. antipodianus*, *A. rainbowi*, *A alannae* and *A. fissifrons* may be found in a wide range of habitats, from open, dry sclerophyll forest to rainforest. *A. antipodianus* may be found in dry, rocky areas with almost no vegetation cover (Kabra, near Rockhampton, 23°22'S, 150°31'E). This species may be more tolerant to sun exposure because of the silver colour of its abdomen (Robinson & Robinson, 1978; Vollrath, 1987). In contrast, I collected *A. miniaceus* only from wet, shaded habitats, e.g. near creeks or along edges of rainforest, although many of this spider's hosts (e.g. *Nephila plumipes*) are common in drier areas.

Relative abundance on host webs differs among species of the kleptobionts. When I surveyed webs of *Nephila edulis* in southeast Queensland, I found an average of 4.47 (± .59 SE) *A. antipodianus* (n=51) with up to 25 individuals per web. *A. miniaceus* can also be numerous: I collected up to 20 of these inquilines from webs of *N. pilipes* (Linnaeus) (usually referred to as *N. maculata*). However, abundance of *A. alannae* and *A. fissifrons* is usually limited to less than five individuals per host web. Of 161 webs of *C. moluccensis* that I observed in eastern Queensland, I found an average of 0.73 (± .09 SE) *A. fissifrons* per web.

The ecology of kleptobiotic *Argyrodes* and their interaction with host spiders is fascinating and complex, and needs to be studied in greater depth. Topics of special interest include the factors that determine the abundance and distribution of *Argyrodes* on host webs, the intrageneric variation in behaviour of the kleptobionts, and the effects of these spiders on host fitness. However, ecological and behavioural studies of these unique spiders should be first validated by a sound taxonomic knowledge of the observed species.

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